IPv4 Multicast Routing MIB
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1. Abstract

This memo defines an experimental portion of the Management Information Base (MIB) for use with network management protocols in the Internet community. In particular, it describes managed objects used for managing IP Multicast Routing for IPv4, independent of the specific multicast routing protocol in use.

2. Introduction

This MIB describes objects used for managing IP Multicast Routing [16], independent of the specific multicast routing protocol [17-21] in use. Managed objects specific to particular multicast routing protocols are specified elsewhere. Similarly, this MIB does not support management of multicast routing for other address families, including IPv6. Such management may be supported by other MIBs.

3. The SNMP Management Framework

The SNMP Management Framework presently consists of five major components:

- An overall architecture, described in RFC 2571 [1].
- Mechanisms for describing and naming objects and events for the purpose of management. The first version of this Structure of Management Information (SMI) is called SMIv1 and described in RFC 1155 [2], RFC 1212 [3] and RFC 1215 [4]. The second version, called SMIv2, is described in RFC 2578 [5], RFC 2579 [6] and RFC 2580 [7].
- Message protocols for transferring management information. The first version of the SNMP message protocol is called SNMPv1 and described in RFC 1157 [8]. A second version of the SNMP message protocol, which is not an Internet standards track protocol, is called SNMPv2c and described in RFC 1901 [9] and RFC 1906 [10]. The third version of the message protocol is called SNMPv3 and described in RFC 1906 [10], RFC 2572 [11] and RFC 2574 [12].
- Protocol operations for accessing management information. The first set of protocol operations and associated PDU formats is described in RFC 1157 [8]. A second set of protocol operations and associated PDU formats is described in RFC 1905 [13].
A set of fundamental applications described in RFC 2573 [14] and the view-based access control mechanism described in RFC 2575 [15].

Managed objects are accessed via a virtual information store, termed the Management Information Base or MIB. Objects in the MIB are defined using the mechanisms defined in the SMI.

This memo specifies a MIB module that is compliant to the SMIv2. A MIB conforming to the SMIv1 can be produced through the appropriate translations. The resulting translated MIB must be semantically equivalent, except where objects or events are omitted because no translation is possible (use of Counter64). Some machine readable information in SMIv2 will be converted into textual descriptions in SMIv1 during the translation process. However, this loss of machine readable information is not considered to change the semantics of the MIB.

4. Overview

This MIB module contains one scalar and five tables. The tables are:

1. the IP Multicast Route Table containing multicast routing information for IP datagrams sent by particular sources to the IP multicast groups known to a router.

2. the IP Multicast Routing Next Hop Table containing information on the next-hops for the routing IP multicast datagrams. Each entry is one of a list of next-hops on outgoing interfaces for particular sources sending to a particular multicast group address.

3. the IP Multicast Routing Interface Table containing multicast routing information specific to interfaces.

4. the IP Multicast Scope Boundary Table containing the boundaries configured for multicast scopes [22].

5. the IP Multicast Scope Name Table containing human-readable names of multicast scope.
5. Definitions

IPMROUTE-STD-MIB DEFINITIONS ::= BEGIN

IMPORTS
    MODULE-IDENTITY, OBJECT-TYPE, mib-2,
    Integer32, Counter32, Counter64, Gauge32,
    IpAddress, TimeTicks FROM SNMPv2-SMI
    RowStatus, TEXTUAL-CONVENTION,
    TruthValue FROM SNMPv2-TC
    MODULE-COMPLIANCE, OBJECT-GROUP FROM SNMPv2-CONF
    SnmpAdminString FROM SNMP-FRAMEWORK-MIB
    InterfaceIndexOrZero,
    InterfaceIndex FROM IF-MIB
    IANAipRouteProtocol,
    IANAipMRouteprotocol FROM IANA-RTPROTO-MIB;

ipMRouteStdMIB MODULE-IDENTITY
    LAST-UPDATED "20000013112000Z" -- January 31, 2000
    ORGANIZATION "IETF IDMR Working Group"
    CONTACT-INFO
        " Dave Thaler
            Microsoft Corporation
            One Microsoft Way
            Redmond, WA  98052-6399
            US
            Phone: +1 425 703 8835
            EMail: dthaler@dthaler.microsoft.com"
    DESCRIPTION
        "The MIB module for management of IP Multicast routing, but
        independent of the specific multicast routing protocol in
        use."
    REVISION     "20000013112000Z" -- January 31, 2000
    DESCRIPTION
        "Initial version, published as RFC xxxx (to be filled in by
        RFC-Editor)."
    ::= { mib-2 XX }
    -- NOTE TO RFC EDITOR: When this document is published as
    -- an RFC, replace XX with IANA-assigned number,
    -- and delete this comment.

    -- Textual Conventions

    LanguageTag ::= TEXTUAL-CONVENTION
DISPLAY-HINT "100a"
STATUS current
DESCRIPTION
"An RFC 1766-style language tag, with all alphabetic characters converted to lowercase. This restriction is intended to make the lexical ordering imposed by SNMP useful when applied to language tags. Note that it is theoretically possible for a valid language tag to exceed the allowed length of this syntax, and thus be impossible to represent with this syntax. Sampling of language tags in current use on the Internet suggests that this limit does not pose a serious problem in practice."
SYNTAX OCTET STRING (SIZE (1..100))

-- Top-level structure of the MIB
ipMRouteMIBObjects OBJECT IDENTIFIER ::= { ipMRouteStdMIB 1 }
ipMRoute OBJECT IDENTIFIER ::= { ipMRouteMIBObjects 1 }
-- the IP Multicast Routing MIB-Group
-- a collection of objects providing information about
-- IP Multicast Groups

ipMRouteEnable OBJECT-TYPE
SYNTAX INTEGER { enabled(1), disabled(2) }
MAX-ACCESS read-write
STATUS current
DESCRIPTION "The enabled status of IP Multicast routing on this router."
::= { ipMRoute 1 }

ipMRouteEntryCount OBJECT-TYPE
SYNTAX Gauge32
MAX-ACCESS read-only
STATUS current
DESCRIPTION "The number of rows in the ipMRouteTable. This can be used
to monitor the multicast routing table size."
::= { ipMRoute 7 }

ipMRouteTable OBJECT-TYPE
SYNTAX SEQUENCE OF IpMRouteEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION "The (conceptual) table containing multicast routing
information for IP datagrams sent by particular sources to
the IP multicast groups known to this router."
::= { ipMRoute 2 }
ipMRouteEntry OBJECT-TYPE
SYNTAX     IpMRrouteEntry
MAX-ACCESS not-accessible
STATUS     current
DESCRIPTION
    "An entry (conceptual row) containing the multicast routing
    information for IP datagrams from a particular source and
    addressed to a particular IP multicast group address.
    Discontinuities in counters in this entry can be detected by
    observing the value of ipMRouteUpTime."
INDEX      { ipMRouteGroup,
             ipMRouteSource,
             ipMRouteSourceMask }
::= { ipMRouteTable 1 }

IpMRouteEntry ::= SEQUENCE {
    ipMRouteGroup                 IpAddress,
    ipMRouteSource                IpAddress,
    ipMRouteSourceMask            IpAddress,
    ipMRouteUpstreamNeighbor      IpAddress,
    ipMRouteInIfIndex             InterfaceIndexOrZero,
    ipMRouteUpTime                TimeTicks,
    ipMRouteExpiryTime            TimeTicks,
    ipMRoutePkts                  Counter32,
    ipMRouteDifferentInIfPackets  Counter32,
    ipMRouteOctets                Counter32,
    ipMRouteProtocol              IANAipMRouteProtocol,
    ipMRouteRtProto               IANAipRouteProtocol,
    ipMRouteRtAddress             IpAddress,
    ipMRouteRtMask                IpAddress,
    ipMRouteRtType                INTEGER,
    ipMRouteHCOctets              Counter64
}

ipMRouteGroup OBJECT-TYPE
SYNTAX     IpAddress
MAX-ACCESS not-accessible
STATUS     current
DESCRIPTION
    "The IP multicast group address for which this entry
    contains multicast routing information."
::= { ipMRouteEntry 1 }

ipMRouteSource OBJECT-TYPE
SYNTAX     IpAddress
MAX-ACCESS not-accessible
STATUS     current
DESCRIPTION
"The network address which when combined with the corresponding value of ipMRouteSourceMask identifies the sources for which this entry contains multicast routing information."
::= { ipMRouteEntry 2 }

ipMRouteSourceMask OBJECT-TYPE
SYNTAX     IpAddress
MAX-ACCESS not-accessible
STATUS     current
DESCRIPTION
"The network mask which when combined with the corresponding value of ipMRouteSource identifies the sources for which this entry contains multicast routing information."
::= { ipMRouteEntry 3 }

ipMRouteUpstreamNeighbor OBJECT-TYPE
SYNTAX     IpAddress
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
"The address of the upstream neighbor (e.g., RPF neighbor) from which IP datagrams from these sources to this multicast address are received, or 0.0.0.0 if the upstream neighbor is unknown (e.g., in CBT)."
::= { ipMRouteEntry 4 }

ipMRouteInIfIndex OBJECT-TYPE
SYNTAX     InterfaceIndexOrZero
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
"The value of ifIndex for the interface on which IP datagrams sent by these sources to this multicast address are received. A value of 0 indicates that datagrams are not subject to an incoming interface check, but may be accepted on multiple interfaces (e.g., in CBT)."
::= { ipMRouteEntry 5 }

ipMRouteUpTime OBJECT-TYPE
SYNTAX     TimeTicks
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The time since the multicast routing information
represented by this entry was learned by the router."
::= { ipMRouteEntry 6 }

ipMRouteExpiryTime OBJECT-TYPE
SYNTAX TimeTicks
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The minimum amount of time remaining before this entry will
be aged out. The value 0 indicates that the entry is not
subject to aging."
::= { ipMRouteEntry 7 }

ipMRoutePkts OBJECT-TYPE
SYNTAX Counter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The number of packets which this router has received from
these sources and addressed to this multicast group
address."
::= { ipMRouteEntry 8 }

ipMRouteDifferentInIfPackets OBJECT-TYPE
SYNTAX Counter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The number of packets which this router has received from
these sources and addressed to this multicast group address,
which were dropped because they were not received on the
interface indicated by ipMRouteInIfIndex. Packets which are
not subject to an incoming interface check (e.g., using CBT)
are not counted."
::= { ipMRouteEntry 9 }

ipMRouteOctets OBJECT-TYPE
SYNTAX Counter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The number of octets contained in IP datagrams which were
received from these sources and addressed to this multicast
group address, and which were forwarded by this router.”
::= { ipMRouteEntry 10 }

ipMRouteProtocol OBJECT-TYPE
SYNTAX   IANAipMRouteProtocol
MAX-ACCESS read-only
STATUS    current
DESCRIPTION  "The multicast routing protocol via which this multicast
forwarding entry was learned."
::= { ipMRouteEntry 11 }

ipMRouteRtProto OBJECT-TYPE
SYNTAX   IANAipRouteProtocol
MAX-ACCESS read-only
STATUS    current
DESCRIPTION  "The routing mechanism via which the route used to find the
upstream or parent interface for this multicast forwarding
entry was learned. Inclusion of values for routing
protocols is not intended to imply that those protocols need
be supported."
::= { ipMRouteEntry 12 }

ipMRouteRtAddress OBJECT-TYPE
SYNTAX   IpAddress
MAX-ACCESS read-only
STATUS    current
DESCRIPTION  "The address portion of the route used to find the upstream
or parent interface for this multicast forwarding entry."
::= { ipMRouteEntry 13 }

ipMRouteRtMask OBJECT-TYPE
SYNTAX   IpAddress
MAX-ACCESS read-only
STATUS    current
DESCRIPTION  "The mask associated with the route used to find the upstream
or parent interface for this multicast forwarding entry."
::= { ipMRouteEntry 14 }

ipMRouteRtType OBJECT-TYPE
SYNTAX   INTEGER {
unicast (1), -- Unicast route used in multicast RIB
multicast (2) -- Multicast route

MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The reason the given route was placed in the (logical)
multicast Routing Information Base (RIB). A value of
unicast means that the route would normally be placed only
in the unicast RIB, but was placed in the multicast RIB
(instead or in addition) due to local configuration, such as
when running PIM over RIP. A value of multicast means that
the route was explicitly added to the multicast RIB by the
routing protocol, such as DVMRP or Multiprotocol BGP."
::= { ipMRouteEntry 15 }

ipMRouteHCOctets OBJECT-TYPE
SYNTAX Counter64
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The number of octets contained in IP datagrams which were
received from these sources and addressed to this multicast
group address, and which were forwarded by this router.
This object is a 64-bit version of ipMRouteOctets."
::= { ipMRouteEntry 16 }
The IP Multicast Routing Next Hop Table

ipMRouteNextHopTable OBJECT-TYPE
   SYNTAX     SEQUENCE OF IpMRouteNextHopEntry
   MAX-ACCESS not-accessible
   STATUS     current
   DESCRIPTION
      "The (conceptual) table containing information on the next-
hops on outgoing interfaces for routing IP multicast
datagrams. Each entry is one of a list of next-hops on
outgoing interfaces for particular sources sending to a
particular multicast group address."
   ::= { ipMRoute 3 }

ipMRouteNextHopEntry OBJECT-TYPE
   SYNTAX     IpMRouteNextHopEntry
   MAX-ACCESS not-accessible
   STATUS     current
   DESCRIPTION
      "An entry (conceptual row) in the list of next-hops on
outgoing interfaces to which IP multicast datagrams from
particular sources to a IP multicast group address are
routed. Discontinuities in counters in this entry can be
detected by observing the value of ipMRouteUpTime."
   INDEX      { ipMRouteNextHopGroup, ipMRouteNextHopSource,
                  ipMRouteNextHopSourceMask, ipMRouteNextHopIfIndex,
                  ipMRouteNextHopAddress }
   ::= { ipMRouteNextHopTable 1 }
IpMRouteNextHopEntry ::= SEQUENCE {
    ipMRouteNextHopGroup IpAddress,
    ipMRouteNextHopSource IpAddress,
    ipMRouteNextHopSourceMask IpAddress,
    ipMRouteNextHopIfIndex InterfaceIndex,
    ipMRouteNextHopAddress IpAddress,
    ipMRouteNextHopState INTEGER,
    ipMRouteNextHopUpTime TimeTicks,
    ipMRouteNextHopExpireTime TimeTicks,
    ipMRouteNextHopClosestMemberHops Integer32,
    ipMRouteNextHopProtocol IANAipMRouteProtocol,
    ipMRouteNextHopPktts Counter32
}

ipMRouteNextHopGroup OBJECT-TYPE
SYNTAX IpAddress
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION "The IP multicast group for which this entry specifies a
next-hop on an outgoing interface."
::= { ipMRouteNextHopEntry 1 }

ipMRouteNextHopSource OBJECT-TYPE
SYNTAX IpAddress
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION "The network address which when combined with the
corresponding value of ipMRouteNextHopSourceMask identifies
the sources for which this entry specifies a next-hop on an
outgoing interface."
::= { ipMRouteNextHopEntry 2 }

ipMRouteNextHopSourceMask OBJECT-TYPE
SYNTAX IpAddress
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION "The network mask which when combined with the corresponding
value of ipMRouteNextHopSource identifies the sources for which this entry specifies a next-hop on an outgoing
interface."
::= { ipMRouteNextHopEntry 3 }

Expires January 2000
ipMRouteNextHopIfIndex OBJECT-TYPE
SYNTAX InterfaceIndex
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"The ifIndex value of the interface for the outgoing
interface for this next-hop."
::= { ipMRouteNextHopEntry 4 }

ipMRouteNextHopAddress OBJECT-TYPE
SYNTAX IpAddress
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"The address of the next-hop specific to this entry. For
most interfaces, this is identical to ipMRouteNextHopGroup.
NBMA interfaces, however, may have multiple next-hop
addresses out a single outgoing interface."
::= { ipMRouteNextHopEntry 5 }

ipMRouteNextHopState OBJECT-TYPE
SYNTAX INTEGER { pruned(1), forwarding(2) }
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"An indication of whether the outgoing interface and next-
hop represented by this entry is currently being used to
forward IP datagrams. The value ‘forwarding’ indicates it
is currently being used; the value ‘pruned’ indicates it is not."
::= { ipMRouteNextHopEntry 6 }

ipMRouteNextHopUpTime OBJECT-TYPE
SYNTAX TimeTicks
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The time since the multicast routing information
represented by this entry was learned by the router."
::= { ipMRouteNextHopEntry 7 }

ipMRouteNextHopExpiryTime OBJECT-TYPE
SYNTAX TimeTicks
MAX-ACCESS read-only
STATUS current

Expires January 2000
DESCRIPTION

"The minimum amount of time remaining before this entry will be aged out. If ipMRouteNextHopState is pruned(1), the remaining time until the prune expires and the state reverts to forwarding(2). Otherwise, the remaining time until this entry is removed from the table. The time remaining may be copied from ipMRouteExpiryTime if the protocol in use for this entry does not specify next-hop timers. The value 0 indicates that the entry is not subject to aging."

::= { ipMRouteNextHopEntry 8 }

ipMRouteNextHopClosestMemberHops OBJECT-TYPE
SYNTAX Integer32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The minimum number of hops between this router and any member of this IP multicast group reached via this next-hop on this outgoing interface. Any IP multicast datagrams for the group which have a TTL less than this number of hops will not be forwarded to this next-hop."

::= { ipMRouteNextHopEntry 9 }

ipMRouteNextHopProtocol OBJECT-TYPE
SYNTAX IANAipMRouteProtocol
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The routing mechanism via which this next-hop was learned."

::= { ipMRouteNextHopEntry 10 }

ipMRouteNextHopPkts OBJECT-TYPE
SYNTAX Counter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The number of packets which have been forwarded using this route."

::= { ipMRouteNextHopEntry 11 }
The Multicast Routing Interface Table

ipMRouteInterfaceTable OBJECT-TYPE
SYNTAX     SEQUENCE OF IpMRouteInterfaceEntry
MAX-ACCESS not-accessible
STATUS     current
DESCRIPTION
  "The (conceptual) table containing multicast routing
  information specific to interfaces."
::= { ipMRoute 4 }

ipMRouteInterfaceEntry OBJECT-TYPE
SYNTAX     IpMRouteInterfaceEntry
MAX-ACCESS not-accessible
STATUS     current
DESCRIPTION
  "An entry (conceptual row) containing the multicast routing
  information for a particular interface."
INDEX      { ipMRouteInterfaceIfIndex }
 ::= { ipMRouteInterfaceTable 1 }

IpMRouteInterfaceEntry ::= SEQUENCE {
  ipMRouteInterfaceIfIndex          InterfaceIndex,
  ipMRouteInterfaceTtl              Integer32,
  ipMRouteInterfaceProtocol         IANAipMRouteProtocol,
  ipMRouteInterfaceRateLimit        Integer32,
  ipMRouteInterfaceInMcastOctets    Counter32,
  ipMRouteInterfaceOutMcastOctets   Counter32,
  ipMRouteInterfaceHCInMcastOctets  Counter64,
  ipMRouteInterfaceHCOutMcastOctets Counter64
}

ipMRouteInterfaceIfIndex OBJECT-TYPE
SYNTAX     InterfaceIndex
MAX-ACCESS not-accessible
STATUS     current
DESCRIPTION
  "The ifIndex value of the interface for which this entry
  contains information."
 ::= { ipMRouteInterfaceEntry 1 }

ipMRouteInterfaceTtl OBJECT-TYPE
SYNTAX     Integer32 (0..255)
**ipMRouteInterfaceTTL**

**MAX-ACCESS** read-write  
**STATUS** current  
**DESCRIPTION**  
"The datagram TTL threshold for the interface. Any IP multicast datagrams with a TTL less than this threshold will not be forwarded out the interface. The default value of 0 means all multicast packets are forwarded out the interface."

```plaintext
::= { ipMRouteInterfaceEntry 2 }
```

**ipMRouteInterfaceProtocol**

**OBJECT-TYPE**  
**SYNTAX** IANAipMRouteProtocol  
**MAX-ACCESS** read-only  
**STATUS** current  
**DESCRIPTION**  
"The routing protocol running on this interface."

```plaintext
::= { ipMRouteInterfaceEntry 3 }
```

**ipMRouteInterfaceRateLimit**

**OBJECT-TYPE**  
**SYNTAX** Integer32  
**MAX-ACCESS** read-write  
**STATUS** current  
**DESCRIPTION**  
"The rate-limit, in kilobits per second, of forwarded multicast traffic on the interface. A rate-limit of 0 indicates that no rate limiting is done."

```plaintext
DEFVAL { 0 }
::= { ipMRouteInterfaceEntry 4 }
```

**ipMRouteInterfaceInMcastOctets**

**OBJECT-TYPE**  
**SYNTAX** Counter32  
**MAX-ACCESS** read-only  
**STATUS** current  
**DESCRIPTION**  
"The number of octets of multicast packets that have arrived on the interface, including framing characters. This object is similar to ifInOctets in the Interfaces MIB, except that only multicast packets are counted."

```plaintext
::= { ipMRouteInterfaceEntry 5 }
```

**ipMRouteInterfaceOutMcastOctets**

**OBJECT-TYPE**  
**SYNTAX** Counter32  
**MAX-ACCESS** read-only  
**STATUS** current  
**DESCRIPTION**
"The number of octets of multicast packets that have been sent on the interface."
::= { ipMRouteInterfaceEntry 6 }

ipMRouteInterfaceHCInMcastOctets OBJECT-TYPE
SYNTAX Counter64
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The number of octets of multicast packets that have arrived on the interface, including framing characters. This object is a 64-bit version of ipMRouteInterfaceInMcastOctets. It is similar to ifHCInOctets in the Interfaces MIB, except that only multicast packets are counted."
::= { ipMRouteInterfaceEntry 7 }

ipMRouteInterfaceHCOutMcastOctets OBJECT-TYPE
SYNTAX Counter64
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The number of octets of multicast packets that have been sent on the interface. This object is a 64-bit version of ipMRouteInterfaceOutMcastOctets."
::= { ipMRouteInterfaceEntry 8 }
--  The IP Multicast Scope Boundary Table
--

ipMRouteBoundaryTable OBJECT-TYPE
SYNTAX     SEQUENCE OF IpMRouteBoundaryEntry
MAX-ACCESS not-accessible
STATUS     current
DESCRIPTION
  "The (conceptual) table listing the router’s scoped multicast address boundaries."
::= { ipMRoute 5 }

ipMRouteBoundaryEntry OBJECT-TYPE
SYNTAX     IpMRouteBoundaryEntry
MAX-ACCESS not-accessible
STATUS     current
DESCRIPTION
  "An entry (conceptual row) in the ipMRouteBoundaryTable representing a scoped boundary."
INDEX      { ipMRouteBoundaryIfIndex, ipMRouteBoundaryAddress, ipMRouteBoundaryAddressMask }
::= { ipMRouteBoundaryTable 1 }

IpMRouteBoundaryEntry ::= SEQUENCE {
  ipMRouteBoundaryIfIndex            InterfaceIndex,
  ipMRouteBoundaryAddress            IpAddress,
  ipMRouteBoundaryAddressMask        IpAddress,
  ipMRouteBoundaryStatus             RowStatus
}

ipMRouteBoundaryIfIndex OBJECT-TYPE
SYNTAX     InterfaceIndex
MAX-ACCESS not-accessible
STATUS     current
DESCRIPTION
  "The IfIndex value for the interface to which this boundary applies. Packets with a destination address in the associated address/mask range will not be forwarded out this interface."
::= { ipMRouteBoundaryEntry 1 }

ipMRouteBoundaryAddress OBJECT-TYPE
SYNTAX     IpAddress
MAX-ACCESS not-accessible
STATUS    current
DESCRIPTION
"The group address which when combined with the corresponding value of ipMRouteBoundaryAddressMask identifies the group range for which the scoped boundary exists. Scoped addresses must come from the range 239.x.x.x as specified in RFC 2365."
::= { ipMRouteBoundaryEntry 2 }

ipMRouteBoundaryAddressMask OBJECT-TYPE
SYNTAX     IpAddress
MAX-ACCESS not-accessible
STATUS     current
DESCRIPTION
"The group address mask which when combined with the corresponding value of ipMRouteBoundaryAddress identifies the group range for which the scoped boundary exists."
::= { ipMRouteBoundaryEntry 3 }

ipMRouteBoundaryStatus OBJECT-TYPE
SYNTAX     RowStatus
MAX-ACCESS read-create
STATUS     current
DESCRIPTION
"The status of this row, by which new entries may be created, or old entries deleted from this table."
::= { ipMRouteBoundaryEntry 4 }

--
-- The IP Multicast Scope Name Table
--

ipMRouteScopeNameTable OBJECT-TYPE
SYNTAX     SEQUENCE OF IpMRouteScopeNameEntry
MAX-ACCESS not-accessible
STATUS     current
DESCRIPTION
"The (conceptual) table listing the multicast scope names."
::= { ipMRoute 6 }

ipMRouteScopeNameEntry OBJECT-TYPE
SYNTAX     IpMRouteScopeNameEntry
MAX-ACCESS not-accessible
STATUS     current
DESCRIPTION

"An entry (conceptual row) in the ipMRouteScopeNameTable representing a multicast scope name."

INDEX

{ ipMRouteScopeNameAddress,
ipMRouteScopeNameAddressMask,
  IMPLIED ipMRouteScopeNameLanguage }
::= { ipMRouteScopeNameTable 1 }

IpMRouteScopeNameEntry ::= SEQUENCE {
  ipMRouteScopeNameAddress            IpAddress,
ipMRouteScopeNameAddressMask        IpAddress,
ipMRouteScopeNameLanguage           LanguageTag,
ipMRouteScopeNameString             SnmpAdminString,
ipMRouteScopeNameDefault            TruthValue,
ipMRouteScopeNameStatus             RowStatus
}

ipMRouteScopeNameAddress OBJECT-TYPE
SYNTAX     IpAddress
MAX-ACCESS not-accessible
STATUS     current
DESCRIPTION

"The group address which when combined with the corresponding value of ipMRouteScopeNameAddressMask identifies the group range associated with the multicast scope. Scoped addresses must come from the range 239.x.x.x."
::= { ipMRouteScopeNameEntry 1 }

ipMRouteScopeNameAddressMask OBJECT-TYPE
SYNTAX     IpAddress
MAX-ACCESS not-accessible
STATUS     current
DESCRIPTION

"The group address mask which when combined with the corresponding value of ipMRouteScopeNameAddress identifies the group range associated with the multicast scope."
::= { ipMRouteScopeNameEntry 2 }

ipMRouteScopeNameLanguage OBJECT-TYPE
SYNTAX     LanguageTag
MAX-ACCESS not-accessible
STATUS     current
DESCRIPTION

"The RFC 1766-style language tag associated with the scope
ipMRouteScopeNameString OBJECT-TYPE
SYNTAX     SnmpAdminString
MAX-ACCESS read-create
STATUS     current
DESCRIPTION
"The textual name associated with the multicast scope. The
value of this object should be suitable for displaying to
end-users, such as when allocating a multicast address in
this scope. When no name is specified, the default value of
this object should be the string 239.x.x.x/y with x and y
replaced appropriately to describe the address and mask
length associated with the scope."
 ::= { ipMRouteScopeNameEntry 3 }

ipMRouteScopeNameDefault OBJECT-TYPE
SYNTAX     TruthValue
MAX-ACCESS read-create
STATUS     current
DESCRIPTION
"If true, indicates a preference that the name in the
following language should be used by applications if no name
is available in a desired language."
DEFVAL { false }
 ::= { ipMRouteScopeNameEntry 4 }

ipMRouteScopeNameStatus OBJECT-TYPE
SYNTAX     RowStatus
MAX-ACCESS read-create
STATUS     current
DESCRIPTION
"The status of this row, by which new entries may be
created, or old entries deleted from this table."
 ::= { ipMRouteScopeNameEntry 5 }
-- conformance information

ipMRouteMIBConformance
OBJECT IDENTIFIER ::= { ipMRouteStdMIB 2 }
ipMRouteMIBCompliances
OBJECT IDENTIFIER ::= { ipMRouteMIBConformance 1 }
ipMRouteMIBGroups OBJECT IDENTIFIER ::= { ipMRouteMIBConformance 2 }

-- compliance statements

ipMRouteMIBCompliance MODULE-COMPLIANCE
  STATUS  current
  DESCRIPTION
    "The compliance statement for the IP Multicast MIB."
  MODULE -- this module
  MANDATORY-GROUPS { ipMRouteMIBBasicGroup,
    ipMRouteMIBRouteGroup}
  GROUP   ipMRouteMIBBoundaryGroup
  DESCRIPTION
    "This group is mandatory if the router supports
    administratively-scoped multicast address boundaries."
)

OBJECT      ipMRouteBoundaryStatus
MIN-ACCESS  read-only
DESCRIPTION
  "Write access is not required."

OBJECT      ipMRouteScopeNameStatus
MIN-ACCESS  read-only
DESCRIPTION
  "Write access is not required."

GROUP   ipMRouteMIBHCInterfaceGroup
DESCRIPTION
  "This group is mandatory only for those network interfaces
  for which the value of the corresponding instance of ifSpeed
  is greater than 20,000,000 bits/second."
 ::= { ipMRouteMIBCompliances 1 }

-- units of conformance

Expires January 2000
ipMRouteMIBBasicGroup OBJECT-GROUP
  OBJECTS { ipMRouteEnable, ipMRouteEntryCount,
           ipMRouteUpstreamNeighbor, ipMRouteInIfIndex,
           ipMRouteUpTime, ipMRouteExpiryTime,
           ipMRouteNextHopState, ipMRouteNextHopUpTime,
           ipMRouteNextHopExpiryTime, ipMRouteNextHopProtocol,
           ipMRouteNextHopPkts, ipMRouteInterfaceTtl,
           ipMRouteInterfaceProtocol, ipMRouteInterfaceRateLimit,
           ipMRouteInterfaceInMcastOctets, ipMRouteInterfaceOutMcastOctets,
           ipMRouteProtocol
    }
  STATUS current
  DESCRIPTION
        "A collection of objects to support basic management of IP
         Multicast routing."
  ::= { ipMRouteMIBGroups 1 }

ipMRouteMIBHopCountGroup OBJECT-GROUP
  OBJECTS { ipMRouteNextHopClosestMemberHops }
  STATUS current
  DESCRIPTION
        "A collection of objects to support management of the use of
         hop counts in IP Multicast routing."
  ::= { ipMRouteMIBGroups 2 }

ipMRouteMIBBoundaryGroup OBJECT-GROUP
  OBJECTS { ipMRouteBoundaryStatus, ipMRouteScopeNameString,
             ipMRouteScopeNameDefault, ipMRouteScopeNameStatus }
  STATUS current
  DESCRIPTION
        "A collection of objects to support management of scoped
         multicast address boundaries."
  ::= { ipMRouteMIBGroups 3 }

ipMRouteMIBPktsOutGroup OBJECT-GROUP
  OBJECTS { ipMRouteNextHopPkts }
  STATUS current
  DESCRIPTION
        "A collection of objects to support management of packet
         counters for each outgoing interface entry of a route."
  ::= { ipMRouteMIBGroups 4 }
ipMRouteMIBHCInterfaceGroup OBJECT-GROUP

OBJECTS { ipMRouteInterfaceHCInMcastOctets, ipMRouteInterfaceHCOutMcastOctets, ipMRouteHCOctets }

STATUS current

DESCRIPTION "A collection of objects providing information specific to high speed (greater than 20,000,000 bits/second) network interfaces."

::= { ipMRouteMIBGroups 5 }

ipMRouteMIBRouteGroup OBJECT-GROUP

OBJECTS { ipMRouteRtProto, ipMRouteRtAddress, ipMRouteRtMask, ipMRouteRtType }

STATUS current

DESCRIPTION "A collection of objects providing information on the relationship between multicast routing information, and the IP Forwarding Table."

::= { ipMRouteMIBGroups 6 }

ipMRouteMIBPktsGroup OBJECT-GROUP

OBJECTS { ipMRoutePkts, ipMRouteDifferentInIfPackets, ipMRouteOctets }

STATUS current

DESCRIPTION "A collection of objects to support management of packet counters for each forwarding entry."

::= { ipMRouteMIBGroups 7 }

END
6. IANA Considerations

The ipMRouteRtProto, ipMRouteNextHopProtocol, ipMRouteInterfaceProtocol, and ipMRouteProtocol use textual conventions imported from the IANA-RTPROTO-MIB. The purpose of defining these textual conventions in a separate MIB module is to allow additional values to be defined without having to issue a new version of this document. The Internet Assigned Numbers Authority (IANA) is responsible for the assignment of all Internet numbers, including various SNMP-related numbers; it will administer the values associated with these textual conventions.

The rules for additions or changes to the IANA-RTPROTO-MIB are outlined in the DESCRIPTION clause associated with its MODULE-IDENTITY statement.

The current versions of the IANA-RTPROTO-MIB can be accessed from the IANA home page at: "http://www.iana.org/".

7. Security Considerations

This MIB contains readable objects whose values provide information related to multicast routing, including information on what machines are sending to which groups. There are also a number of objects that have a MAX-ACCESS clause of read-write and/or read-create, such as those which allow an administrator to configure multicast boundaries.

While unauthorized access to the readable objects is relatively innocuous, unauthorized access to the write-able objects could cause a denial of service, or could cause wider distribution of packets intended only for local distribution. Hence, the support for SET operations in a non-secure environment without proper protection can have a negative effect on network operations.

SNMPv1 by itself is such an insecure environment. Even if the network itself is secure (for example by using IPSec), even then, there is no control as to who on the secure network is allowed to access and SET (change/create/delete) the objects in this MIB.

It is recommended that the implementers consider the security features as provided by the SNMPv3 framework. Specifically, the use of the User-based Security Model RFC 2574 [12] and the View-based Access Control Model RFC 2575 [15] is recommended.

It is then a customer/user responsibility to ensure that the SNMP entity giving access to this MIB, is properly configured to give access to
those objects only to those principals (users) that have legitimate rights to access them.

8. IANA Routing Protocol Registration MIB

This appendix defines the initial content of the IANA-RTPROTO-MIB.

NOTE TO RFC-EDITOR: This section should be removed from this document prior to its publication, at which time this MIB will be administered by IANA.

IANA-RTPROTO-MIB DEFINITIONS ::= BEGIN

IMPORTS
MODULE-IDENTITY, mib-2 FROM SNMPv2-SMI
TEXTUAL-CONVENTION FROM SNMPv2-TC;

ianaipRouteProtocol MODULE-IDENTITY
LAST-UPDATED "200001311200Z" -- January 31, 2000
ORGANIZATION "IANA"
CONTACT-INFO
" Internet Assigned Numbers Authority
   Internet Corporation for Assigned Names and Numbers
   4676 Admiralty Way, Suite 330
   Marina del Rey, CA 90292-6601
   Phone: +1 310 823 9358
   EMail: iana@iana.org"
DESCRIPTION
"This MIB module defines the IANAipRouteProtocol and IANAipMRRouteProtocol textual conventions for use in MIBs which need to identify unicast or multicast routing mechanisms.

Any additions or changes to the contents of this MIB module require either publication of an RFC, or Designated Expert Review as defined in the Guidelines for Writing IANA Considerations Section document. The Designated Expert will be selected by the IESG Area Director(s) of the Routing Area."
::= { mib-2 xxx } -- TO BE ASSIGNED BY IANA

IANAipRouteProtocol ::= TEXTUAL-CONVENTION
STATUS current
DESCRIPTION

"A mechanism for learning routes. Inclusion of values for routing protocols is not intended to imply that those protocols need be supported."

SYNTAX

INTEGER {
    other     (1),  -- not specified
    local     (2),  -- local interface
    netmgmt   (3),  -- static route
    icmp      (4),  -- result of ICMP Redirect

    -- the following are all dynamic
    -- routing protocols

    egp        (5),  -- Exterior Gateway Protocol
    ggp        (6),  -- Gateway-Gateway Protocol
    hello     (7),  -- FuzzBall HelloSpeak
    rip        (8),  -- Berkeley RIP or RIP-II
    isIs      (9),  -- Dual IS-IS
    esIs      (10),  -- ISO 9542
    ciscoIgrp  (11),  -- Cisco IGRP
    bbnSpfIgp  (12),  -- BBN SPF IGP
    ospf      (13),  -- Open Shortest Path First
    bgp       (14),  -- Border Gateway Protocol
    idpr      (15),  -- InterDomain Policy Routing
    ciscoEigrp (16),  -- Cisco EIGRP
    dvmrp     (17)  -- DVMRP
}

IANAIPv4RouteProtocol ::= TEXTUAL-CONVENTION
STATUS    current
DESCRIPTION
"The multicast routing protocol. Inclusion of values for multicast routing protocols is not intended to imply that those protocols need be supported."

SYNTAX

INTEGER {
    other(1),  -- none of the following
    local(2),  -- e.g., manually configured
    netmgmt(3),  -- set via net.mgmt protocol
    dvmrp(4),
    mospf(5),
    pimSparseDense(6),  -- PIMv1, both DM and SM
    cbt(7),
    pimSparseMode(8),  -- PIM-SM
    pimDenseMode(9),  -- PIM-DM
    igmpOnly(10),
}
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10. Acknowledgements

This MIB module was updated based on feedback from the IETF’s Inter-Domain Multicast Routing (IDMR) Working Group.

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12. References


Virtual Holdings, International Network Services, April 1999.


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